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Military Aircraft, the F/A-18E/F Super Hornet Program: Background and Issues for Congress

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Military Aircraft, the F/A-18E/F Super Hornet Program: Background and Issues for Congress

Summary

The F/A-18E/F Super Hornet is described by some as the latest version of the Navy's carrier-based F/A-18 fighter/attack plane, with more range/payload and better avionics and weapons than the A/B and C/D models. Other's describe the Super Hornet as an entirely new aircraft. The F/A-18E/F entered production in FY1997 to replace current F/A-18s as well as other carrier-based planes.

In the early 1990s, the Navy's plans for modernizing carrier aviation included the upgraded F/A-18E/F and a projected AFX aircraft that was later canceled. As the only current aircraft program for modernizing Navy fighter and attack capabilities, the F/A-18E/F is considered critical to the future of naval aviation.

Whether this program was the most cost-effective way to modernize naval aviation has been questioned. Proposed alternatives to the F/A-18E/F have included developing a fighter/attack version of the F-14 fighter, continued use of the F/A-18C/D version, or increased procurement of the Joint Strike Fighter when it is fielded.

In May 1997, the Defense Department recommended procurement of between 548 and 785 F/A-18E/Fs instead of the 1,000 aircraft projected originally. A 462-plane program (not including 90 EA-18Gs) was estimated in December 2003 to cost about $43..87 billion in current-year dollars.

The FY2000 budget requested $2,997 million for a 36-plane buy, which was authorized and appropriated by Congress as requested, with permission to begin multi-year procurement of the F/A-18E/F. The Administration's FY2001 budget funded procurement of 42 F/A-18E/F Super Hornets, with requests for $3,080.6 million in procurement and development funds. This request was approved, but with a $30 million cut in appropriations. The Administration's FY2002 request for $3.1 billion to procure 48 aircraft was also met by appropriators, but at a slight reduction in funding. The Administration requested $3.1 billion to procure 44 Super Hornets in FY2003, a reduction of four aircraft from previous projections. The FY2004 request was for $3.2 billion in procurement (42 aircraft) and R&D funding, which was matched by appropriators. The FY2005 request is for $3.4 billion in F/A-18E/F and EA-18G procurement funding and $134 million in F/A-18 R&D funds.

The Super Hornet successfully completed it's six-month operational testing and evaluation (OT&E) phase in November 1999. Based on this successful operational evaluation, on June 16, 2000 the Navy announced the signing of a multi-year contract with Boeing Company for the F/A-18E/F full rate production. Under the 5-year contract, the Navy agrees to pay $8.9 billion for 222 aircraft. Strike Fighter Squadron 115 (VFA-115) at Naval Air Station Lemoore, CA was the first fleet operational F/A-18E/F squadron and has seen combat in Iraq and Afghanistan. VFA-14 and VFA-41 also employ the Super Hornet.

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Introduction

Development of the F/A-18E/F Super Hornet — a significantly modified and upgraded version of the Navy's F/A-18C/D fighter/attack plane — began in 1991, as one of the two major programs originally proposed for modernizing carrier-based aircraft. The other was the AFX program to develop a new attack plane, but that program was canceled in late 1993. Since then, the F/A-18E/F has been the only active program for modernizing the Navy's air-to-air fighter capabilities as well as air-to- surface attack capabilities. The Joint Strike Fighter (JSF) program, currently projected by Defense Department officials to produce up to 680 new fighter/attack planes for the Navy and Marine Corps, could yield operational aircraft in the 2010s.[1]

Most of the planes on an aircraft carrier are fighters (mainly for air-to-air combat), attack planes (for air-to-surface combat), and fighter/attack planes, also called strike-fighters (performing both air-to-air and air-to-surface combat). Since the retirement of all A-6E attack planes in early 1997, their air-to-surface attack missions have been performed by F-14 fighter/attack versions (first used in Bosnia in 1995) and F/A-18C/D strike-fighters — both of which are to be replaced by the F/A-18E/F aircraft.

In early 1991, the Navy faced a choice as to which of these three mission areas to modernize with limited funds. Funds were deemed sufficient only for one entirely new plane and one major upgrade to an existing plane. Focusing on power projection, traditionally viewed by some as the Navy's most important mission, and considering the age of the A-6E attack planes, the Navy chose the attack mission as the one for which an entirely new plane would be developed. This became the AFX (originally known as the AX) program, which succeeded the ill-fated A-12 effort that was terminated in January 1991. Efforts to develop a carrier-based naval version of the Air Force's F-22 Advanced Tactical Fighter were also abandoned in 1991, and proposals for a carrier-capable version of the Air Force's F-117 were never endorsed by Navy leadership.

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[1] As part of a plan to more intimately integrate Navy and Marine Corps tactical aviation, in 2003 the Navy and Marine Corps reduced their planned purchase of JSFs by 409 aircraft, from 1,089 to 680. Also, see CRS Report RL30563, *Joint Strike Fighter (JSF) Program: Background, Status, and Issues*. For a current overview of all ongoing U.S. tactical aircraft programs, see CRS Issue Brief IB92115, *Tactical Aircraft Modernization: Issues for Congress*.

With the limited amount of money available after funding the AFX, the Navy faced a choice of pursuing either a modest upgrade of the F-14 — a large, two-seat fighter designed in the 1960s, with potential air-to-surface attack capabilities — or a major upgrade of the F/A-18 — a smaller, one- or two-seat strike-fighter designed in the 1970s as a lower-cost supplement to the F-14. Various upgrade options were proposed for both the F-14 and the F/A-18. In 1993, the House and Senate Armed Services Committees recommended development of both the F/A-18E/F and an attack-capable version of the F-14.

Proponents of the F/A-18E/F argued that upgrading the F/A-18 to take over the F-14's air-to-air combat mission would cost less in procurement and operating expenses than upgrading the F-14 to take over the F/A-18's air-to-surface attack mission. Some also argued that the F-14's long-range air defense mission, known as the outer air battle, will be less important in the post-Cold War era, when naval aircraft are expected to be used at shorter ranges in littoral (off-shore) operations in Third-World scenarios.

Some consider reliance on the F/A-18E/F an acceptable risk in the absence of Soviet air threats to the carriers and believe that earlier plans for modernizing carrier aviation are unaffordable in the present budgetary environment. In 1991, Secretary of the Navy Lawrence Garrett described the F/A-18E/F as the "only affordable program that will keep our vital carrier decks covered [and] will give us a credible war-fighting capability while we develop the AX."[2] Navy officials emphasized in 1991-92 that affordability and inventory requirements were the driving factors in their support of the F/A-18E/F over the F-14D, whose higher-performance air-to-air radar and greater range and payload capabilities they considered less essential for fleet defense with the demise of a Soviet threat.

The F/A-18E/F will replace earlier versions of the F/A-18 the F-14, although the F/A-18E/F lacks some of the range and payload, and all-weather attack capabilities of the F-14. In addition to some 20 support aircraft, carrier airwings have generally included about 20 F-14 fighters, 20 F/A-18 strike-fighters, and up to 20 A-6E attack planes, but future airwings are likely to comprise up to 36 F/A-18 strike-fighters and about 14 F-14 fighters with some attack capability. If a carrier-capable version of the proposed Joint Strike Fighter (JSF) is developed and produced, the JSF could complement or replace the F/A-18E/F in the 2010s.

The F/A-18E/F Program

System Description and Performance Compared to the F/A-18C/D

Some observers describe the F/A-18E/F as an upgraded and larger version of the F/A-18C/D, with increased range and payload capacity and more space and weight

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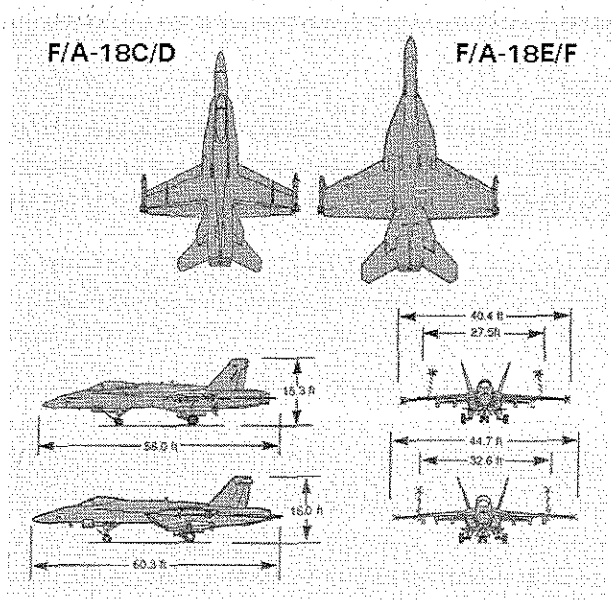
[2] "McDonnell Douglas, Navy Determined to Keep F/A-18 from Harm's Way," *Inside the Navy*, Sept. 16, 1991. p5.

for future improvements. Other observers assert that the differences between the baseline Hornet aircraft and the E/F model are so great that they would describe the Super Hornet as an entirely new aircraft. The single-seat F/A-18E and twin-seat F/A-18F will replace the single-seat C and twin-seat D versions of the F/A-18, which have been in production since 1986. Compared to the F/A-18C/D, the F/A-18E/F has a longer fuselage (+4.3 ft) and a 25% larger wing, providing 33% more internal fuel capacity (14,500 vs. 10,381 lb.); two additional weapon stations (11 vs. 9); and survivability improvements (e.g., new electronic warfare equipment and reduced vulnerable areas). The F/A-18E/F is powered by two upgraded F414-GE-400 engines (developed originally for the A-12), producing 36% more thrust than the C/D's F404 engines. Using 480-gal tanks increases the E/F's external fuel capacity to 9,800 lb. (vs. the C/D's 6,700 lb. with 330-gal tanks). The use of low-observable materials and shaping makes the E/F less detectable by radar.

Figure 1: Comparison of F/A-18 Dimensions



In 1992 the F/A-18's operational requirements specified a combat radius of 410 nmi for fighter missions and 430 nmi for attack missions. Such ranges were not achieved by the F/A-18C/D, whose range/payload capabilities have been reduced by weight growth due to equipment added in successive upgrades since 1982, when its combat radius was 366 nmi in fighter missions and 415 nmi in attack missions. In 1992 the Navy projected the F/A-18E/F's fighter combat radius to be about 420 nmi, with an attack radius of about 490 nmi — exceeding requirements of 410 nmi and 430 nmi for these missions. In carrier landings, the F/A-18E/F could bring back 9,000 lb of fuel/ordnance payload vs. the C/D's recovery payload of about 6,000 lb.

These improvements in range, payload, and bring-back capability, are viewed by the Navy as the primary advantages of the E/F version. In 1996, the General Accounting Office seriously questioned the F/A-18E/F's performance advantages over the current C/D version, arguing that F/A-18C/Ds could provide similar

capabilities at lower costs.[3] The Navy did not agree with these GAO conclusions, which were cited during Senate debate on the F/A-18E/F program in July 1996.

Table 1. Comparison of F/A-18 C/D and E/F

	C/D	E/F
Unit Procurement Cost	$39.3[a]	$91 million[b]
Propulsion	2 F404-GE-402 turbofans	2 F414-GE-400 turbofans
Thrust	17,700 lbs	22,000 lbs
Length	56 feet	60 feet, 4 inches
Height	15 feet, 4 inches	16 feet
Wingspan	40 feet, 5 inches	44 feet, 11 inches
Speed	Mach 1.7	Mach 1.8
External fuel capacity	6,700 lbs	9,800 lbs
Un-refueled Combat Radius	Fighter: 366 nmi Attack: 415 nmi	Fighter: 420 nmi Attack: 490 nmi
Weapon hard points	9	11
First Flight	November 1978	December 1995

Notes:
a. Selected Acquisition Reports, Dec. 31, 1994, DOD Comptroller, adjusted for inflation and expressed in 2001 dollars.
b. Selected Acquisition Reports, Dec. 31, 2003. DOD Comptroller, assumes 552 aircraft purchase: 462 F/A-18E/F variants, and 90 EA-18G variants.

In December 1997, the F/A-18E/F's persistent performance problems in high-speed maneuvers led the Navy to delay FY1998 funding for the program pending solution of these problems. First experienced in March 1996, the aircraft's "wing-drop" problem may occur during turns at speeds of .6 to .9 Mach (speed of sound), when the wing loses lift and the plane rolls unexpectedly to the left or right, preventing the pilot from tracking a target. Since this anomaly was apparently related to the wing's leading edge, some feared the wing might have to be redesigned; others thought the problem could be resolved by modifications of the wing, such as adding a "porous wing fairing." After successful flight testing of this modification, Secretary of Defense Cohen approved FY1998 funding for procurement of another 20 aircraft on April 3, 1998.

The F/A-18E/F's radar will also differentiate it from earlier models. Under current plans, 258 of the Super Hornets procured by the Navy will field an active electronically steered array (AESA) radar. Conventional radars are limited, in part,

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[3] U.S. General Accounting Office, *Navy Aviation: F/A-18E/F Will Provide Marginal Operational Improvement at High Cost*, GAO/NSIAD-96-98, June 1996.

by the speed with which its antenna can be mechanically moved. Recent improvements in electronics technology enable AESA radars to update a radar's computer several times a second.[4] AESA radars are expected to offer up to 30 times the net radar capability of mechanically steered radars.[5] They are hoped to be more reliable, and to be able to perform several different functions almost simultaneously. Many believe that in addition to seeking out and locking on to enemy targets, AESA radars will also offer powerful electronic warfare capabilities, specifically the ability to jam enemy radars that attempt to target the F/A-18E/F.[6] It is currently unclear exactly how effective this jamming capability will be and if it will complement or compete with the electronic attack capabilities offered by the proposed EA-18G model.

AESA radars are hoped to be fielded in F/A-18E/F models as part of a Block II upgrade in 2006. Other upgrades — Advanced Targeting Forward Looking Infrared (ATFLIR), Joint Helmet Mounted Cuing System (JHMCS), JDAM Hornet Autonomous Real-Time Targeting Capability, and for the F model the Advanced Crew Station — are hoped to combine with AESA to give the Super Hornet superior all weather precision attack capabilities against time-critical targets.[7]

Cost Estimates and Projected Schedule

The Defense Department's Selected Acquisition Report (SAR) of December 31, 2003, estimated the acquisition cost of a 462-aircraft program at $43.87 billion. The cost of procuring 90 EA-18G electronic attack variants is estimated at $8.4 billion. The currently planned F/A-18E/F program reflects the Department of the Navy's implementation of its Tactical Air Integration Plan (TAI), which includes an 88-plane reduction in the number of Super Hornets to be procured. The implications of this in the overall program, in terms of cost and other factors, is still being studied.[8]

The F/A-18E/F program began officially in May 1992 with approval by the Defense Acquisition Board (DAB) to begin engineering/manufacturing development

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[4] David Fulghum, "Cool, Small, Cheap Defines Flexible Next Generation Radar," *Aviation Week & Space Technology,* Sept. 11, 2000, p. 61.

[5] Report of the Defense Science Board Task Force on Future DoD Airborne High Frequency Radar Needs/Resources, April 2001, Office of the Under Secretary of Defense for Acquisition and Technology.

[6] Lorenzo Cortes, "AESA Allows Super Hornet to Perform Tactical Electronic Attack, Navy Official Says." *Defense Daily,* Dec. 4, 2002. and "New Sensors Grab Extra Combat Roles," *Aviation Week & Space Technology.* Sept. 11, 2000.

[7] Stephen Trimble, "Super Hornet Crews Ponder New Missions as Block II Upgrades Arrive," *Aerospace Daily,* Sept. 9, 2003, and Christopher Castelli, "Navy to Integrate JDAM HART with Super Hornet's AESA Radar," *Inside the Navy,* Oct. 13, 2003.

[8] Key elements of the TAI plan is to operate a smaller number of strike fighters, reduce the planned procurement of strike fighters, increase the readiness of Navy aircraft, increase funding for modernization, and increase cross-assignment of Navy and Marine Corps fighter squadrons. For more information, see CRS Report RS21488, *Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress.*

(EMD). On July 21, 1992, the Navy awarded two contracts to get EMD under way, with McDonnell Douglas receiving $97 million from a $3,964-million contract to develop the airframe and General Electric receiving $94 million from a $754-million contract to develop the F414-GE-400 engine. On September 18, 1995, the Navy received the first of seven EMD aircraft to be flight-tested in 1995-98. By September 1997, these test planes had logged some 1,500 flight hours, with carrier-based flights beginning in January 1997 aboard the USS John C. Stennis. The results of these flight tests were generally good, although some engine problems in 1996-97 had to be resolved, and there were serious problems in air combat maneuvers at high speed, which in December 1997 led the Navy to withhold $1.5 billion in FY1998 funds pending solution of what was termed a "wing drop" problem. By late March 1998, various mechanical fixes to the wings were being flight-tested in the effort to resolve this problem.

The Defense Department's Quadrennial Defense Review (QDR) of May 19, 1997, recommended reducing procurement of F/A-18E/Fs from 1,000 aircraft to 548, with the possibility of buying up to 785 if the Joint Strike Fighter (JSF) program were delayed or if the aircraft were too expensive compared to the F/A-18E/F. Defense Secretary William Cohen stated that this would set up "creative tension" between the contractors producing the JSF and the F/A-18E/F. The QDR also recommended reducing the maximum annual production rate to 48 aircraft. These recommendations were reflected in the FY1999 budget's procurement projections.

The FY1999 defense budget projected the following annual buys: FY1999 — 30; FY2000 — 36; FY2001 — 42; FY2002 — 48; FY2003 — 48. The FY2000 budget projected 48-plane buys through FY2005. The first production aircraft were delivered in 1999 for operational testing and evaluation, with initial operating capability (IOC) in 2001.

On December 7, 1998, the Defense Department announced the Navy's award of a contract to start production of the 30 aircraft funded in FY1999. Up to seven production aircraft began operational testing and evaluation (OT&E) flights in late May of 1999 at China Lake, CA, which continued through November 1999. In March 2000, Navy test squadron VX-9 reported that the F/A-18EF had passed its six month OT&E. The squadron flew 1,233 hours in 850 "missions," performed more than 24 carrier operations, and participated in a "Red Flag" exercise. Based on this successful operational evaluation, on June 16, 2000 the Navy announced the signing of a multi-year contract with Boeing Company for the F/A-18E/F full rate production. Under the five-year contract, the Navy agreed to pay $8.9 billion for 222 aircraft. The second F/A-18E/F multi-year procurement contract — estimated at $8.9 billion over five years to procure 222 aircraft — was awarded in December 2003 (See "Program Management and Technical Risks" section, below).

Sales, Operations, and Basing

In June 2001 the Department of Defense approved the Super Hornet for international export.[9] Malaysia, which currently operates the two-seat F/A-18/D, appears to be the most serious potential importer. On September 4, 2002, DOD notified Congress of the potential sale of 18 F/A-18Fs to Malaysia as part of a larger $1.48 billion arms deal.[10] Other potential F/A-18E/F importers include Australia, Finland, Kuwait, Spain and Switzerland.

Generally speaking, arguments for foreign military sales tend to focus on advancing U.S. industry, supporting allied countries, and promoting interoperability with those countries. Arguments against arms sales tend to focus on the negative aspects of military technology proliferation and the potential for causing regional instability. The government approves arms sales on a case-by case basis.[11]

Strike Fighter Squadron 115 (VFA-115), based at Naval Air Station Lemoore, CA is the first fleet operational F/A-18E/F squadron. VFA-115 Super Hornets deployed in the summer of 2002 aboard the USS *Abraham Lincoln* (CVN-72). This 12-plane squadron flew approximately 90 mission over Afghanistan in support of Operation Enduring Freedom.[12] VFA-115 also deployed to the Persian Gulf region and participated in Operation Southern Watch, enforcing the "No-Fly Zones" over Iraq. In November 2002, F/A-18E/F aircraft used the Joint Direct Attack Munition (JDAM) to attack Iraqi surface-to-air missile systems and a command and control communications facility.[13] F/A-18E/F squadrons from the aircraft carriers Abraham Lincoln and Nimitz are participating in Operation Iraqi Freedom.

On September 10, 2003, the Navy released its decision to base eight F/A-18E/F fleet squadrons and one fleet replacement squadron (120 aircraft) at Naval Air Station (NAS) Oceana, (VA), two fleet squadrons (24 aircraft) at Marine Corps Air Station (MCAS) Cherry Point (NC) and to construct an outlying field in Washington County, N.C.[14]

Alternatives to the F/A-18E/F Program

The F/A-18E/F is the only surviving part of a naval aviation procurement plan that emerged in 1991-92, which included originally the A-12 and later the AFX as proposed successors to the A-6E attack plane. Various options for modernizing the

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[9] "Boeing's Super Hornet Cleared for International Sales," *Defense Daily,* Aug. 7, 2001.

[10] Michael Sirak, "Malaysia Seeks Super Hornets to Augment F/A-18 Fleet," *Jane's Defense Weekly,* Sept. 18, 2002.

[11] For more information on arms sales, see CRS Report RS20757 and CRS Report RL31529.

[12] Tony Capaccio, "Boeing Super Hornet, New U.S. Fighter, Begins Patrols Over Iraq," *Bloomberg.com,* Oct. 31, 2002.

[13] "Super Hornets Make Combat Debut," *Defense Daily,* Nov. 8, 2002, p.4.

[14] "Navy Issues Decision on Super Hornet Basing," *Immediate Release,* No. 663-03. Department of the Navy, Sept. 10, 2003.

Navy's fighter, strike-fighter, and attack aircraft were discussed in Congress and the Defense Department during the early 1990s, such as (1) developing an entirely new strike-fighter aircraft (attack plane with fighter capability) along AFX lines, or a derivative of the Air Force F/A-22 stealth aircraft, and (2) upgrading the F-14 to add attack-capability to the Navy's high-performance fighter plane. By the mid-1990s, none of these options appeared to offer a viable alternative to the F/A-18E/F program, although during 1995 there was some congressional interest in a proposal by Lockheed Martin to develop a carrier-capable Navy version of the Air Force F-117 stealth aircraft that was used in the 1991 Gulf War.[15] Considering the intense budget pressure associated with DOD's desire to procure three new tactical aircraft (F/A-18E/F, Joint Strike Fighter, and F/A-22 Raptor), another alternative might be to accelerate the development of and increase the Navy's procurement of the Joint Strike Fighter.

EA-18G

The Department of Defense is currently facing a shortage of radar and communications jamming capability. The Navy and Marine Corp's EA-6B *Prowlers* escort and protect Navy, Marine Corps and Air Force aircraft operating in hostile airspace. The Prowlers, however, are few and rapidly aging.[16] All the Services are evaluating preferred approaches to ameliorating this shortfall. The Navy's preferred approach is to produce a new electronic attack aircraft based on the F/A-18F, called the EA-18G.

Basing the EA-6B's replacement on the F/A-18E/F airframe is attractive to the Navy because it is expected to engender less new training, operations and maintenance than a new type of aircraft. Operating an electronic attack aircraft that can fly at the same speed and to the same ranges as the strike aircraft it is supporting should also generate operational benefits. The Marine Corps does not operate, and currently does not plan to procure the FA/18-E/F, so fielding the EA-18G is presumably less attractive to that Service.

The EA-18G would share the F/A-18F's airframe and avionics, and be built on the same assembly line. The EA-18G would replace the F-model's cannon with a nose-mounted jamming processor and carry up to five ALQ-99 jamming pods. These are the same jamming pods currently employed by the EA-6B. In May 2003 it was announced that the Navy had decided that the E/F and G models would not share as much commonality as previously planned. F-model F/A-18s are being designed so that they can be easily and cheaply converted into a G-model if the need arises. EA-18Gs however, will not be easily or cheaply converted to F-models.[17]

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[15] CRS Report 96-660 F, *A/F-117X Aircraft Proposal: Background and Issues for Congress* by Valerie Bailey Grasso. (Out of print. For copies, call Chrisopher Bolkcom at 202-707-2577).

[16] See CRS Report RL30639 for more information on the EA-6B and Electronic Warfare.

[17] Stephen Trimble, "EA-18G Design Begins to Diverge from Super Hornet," *Aerospace Daily,* May 28, 2003.

F/A-18F and EA-18G models are expected to be produced on the same production line starting in FY2008. The Navy awarded a $1 billion contract to Boeing for system design and development (SDD).[18] The Navy's currently envisioned program includes a total buy of 90 EA-18Gs to augment and replace the aging EA-6B force. Despite the pressing need to replace the Prowlers, DOD may delay the EA-18G's procurement by one year (FY2007 instead of FY2006) due to a $150 million shortfall in the Growler's RDT&E account.[19]

Key Issues for Congress

Congressional discussion of the F/A-18E/F proposal has focused on three key issues: (1) mission capabilities and threat requirements for carrier-based fighter planes in the 1990s and beyond, (2) their projected costs and inventory requirements, and (3) program management and technical risks. Projected force levels, changing threat environments, and the capabilities and costs of F/A-18 vs. F-14 fighters and Joint Strike Fighters have been at issue in congressional debate over the proposed upgrade program.

Mission Capabilities and Threat Requirements

Proponents of the F/A-18E/F acknowledge that the plane would lack some of the F-14D's mission capabilities in range/payload, speed, and all-weather attack capability, but they argue that the demise of the Soviet threat has fundamentally changed the requirements that carrier-based fighters must meet. Armed with the long-range (100 nmi) Phoenix air-intercept missile, the F-14 was designed in the early 1970s to defend U.S. aircraft carriers in mid-ocean waters against Soviet aircraft armed with long-range anti-ship cruise missiles. Some advocates of the F/A-18E/F argue that such a long- range, mid-ocean air defense scenario is now implausible, as reflected in the Navy's current emphasis on littoral operations in Third-World conflicts. Some Navy officials argued in 1991 that the F-14D would be about 3.5 times as vulnerable to certain surface-to-air munitions as the F/A-18E/F would be, because of its smaller size and reduced radar signature, which provide some of the operational advantages of stealth aircraft.[20]

Proponents of the F-14D emphasize this high-performance fighter's inherent advantages in range/payload/endurance, which they believe may still be needed in some threat scenarios, where sophisticated aircraft and air defense systems are likely to be available to hostile forces in regional conflicts involving the U.S. Navy. F-14 supporters also argue that the long-range detection and multi-target tracking

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[18] "Navy Awards Boeing $9.6 Billion in Super Hornet and EA-18G Contracts," Press Release, The Boeing Company. St. Louis, Dec. 29, 2003.

[19] Amy Butler, "Comptroller Proposes One-Year Slip to Growler Airborne Jammer," *Defense Daily,* Nov. 20, 2003.

[20] "Navy's Response to Congress on F/A-18E/F Procurement," *Inside the Navy,* Sept. 16, 1991: 6-7

capabilities of the F-14D's radar and target sensors can be used to command and control other aircraft, thus extending fleet surveillance.

Some believe that the only carrier aircraft likely to be built in current budgetary conditions will be a version of the F/A-18, which some argue would be adequate for a low-threat environment in which the Navy's traditional power-projection roles could be performed by other means, such as sea-launched precision munitions or land-based aircraft. Opponents of this view believe that carrier aircraft with more range and payload capabilities than that provided by any F/A-18 variant may well be needed in some future crisis, either as a credible deterrent or as a means of attacking hostile targets in wartime.

The Navy and Marine Corps are both planning on procuring variants of the F-35 Joint Strike Fighter (JSF). This aircraft is expected to be operational in the 2010 time frame. Some argue that the JSF will be a clearly more capable aircraft. It will be stealthy, employ advanced, integrated avionics, and the most modern agile electronically scanned array (AESA) radars. Improved enemy air defenses suggest that the Navy field these kinds of strike fighter attributes quickly if it is to remain survivable, and relevant on tomorrow's battlefield. In addition to these operational attributes, the JSF will also be less expensive to procure and to operate than the Super Hornet.

Super Hornet advocates argue that while the JSF will be a valuable contribution to the Navy inventory, its capabilities complement the F/A-18E/F, they do not supercede it. It is not clear that stealth technology is required immediately, and stealthy aircraft have not proven invulnerable in recent conflicts. Also, to maintain its stealthy signature, the JSF must carry its weapons internally, which limits its payload.

Projected Costs and Inventory Requirements

Comparisons between the acquisition costs of the F/A-18E/F and an attack-capable version of the F-14D, such as the F-14D Quick Strike, have been highly conjectural because of conflicting estimates of development and production costs, and projected inventory requirements. In mid-1991, Department of Defense (DOD) officials estimated their flyaway unit costs in FY1990 dollars as $33 million for the F/A-18E/F vs. $44.5 million for the F-14D Quick Strike. F-14 supporters noted, however, that flyaway costs do not include development costs, which would be several billion dollars for the F/A-18E/F vs. several hundred million for the F-14D Quick Strike. They noted further that these flyaway costs assumed annual buys of 72 F/A-18s vs. 24 F-14s, and they argued that comparable 72-plane buys would reduce the cost of each F-14D Quick Strike to $34.5 million, approaching the cost of an F/A-18E/F. Others have noted, however, that no naval aircraft have been bought in such quantities in recent years, and it is unlikely that such annual buys will be funded in the early 2000s, given expected force reductions and lower inventory requirements and the absence of consensus about future military threats.

In mid-1991, DOD officials estimated that the costs of operating and supporting the F/A-18E/F in 13 carrier air wings for 20 years would be about $9 billion cheaper than using the F-14, based on projections of significantly lower costs for the

F/A-18E/F compared to the F-14A.[21] These comparisons have been challenged on grounds that they were based on data that did not reflect the F-14D version's better maintenance, reliability, and safety record compared to the original F-14A version.[22]

JSF advocates argue that the F/A-18E/F program should be truncated and the JSF program should be accelerated. It makes little sense, they say, to continue purchasing two types of aircraft that perform the essentially same role, especially when one is clearly superior. The Super Hornet is a "stop-gap" program, JSF proponents say, designed to fill the void left by the cancelled A-12. The ease with which the U.S. Air Forces have dominated its recent military opponents (e.g., Kosovo, Afghanistan, Iraq) suggest that the current inventory of F-14s and F/A-18C/Ds will continue to be effective until the JSF is fielded. Much can be saved by truncating the Super Hornet and buying the JSF in even greater numbers.

Super Hornet advocates argue that the current fleet of aircraft, especially the F-14s is too old to maintain and operate effectively, and should be retired as planned. Navy strike capabilities will be jeopardized if these old aircraft continue to represent the bulk of the fleet. While the Navy looks forward to the JSF's eventual deployment, F/A-18E/F proponents point out that it is still in development, and there is no guarantee that it will be fielded on time. Many aviation programs, such as the C-17 Globemaster, RAH-66 Comanche, and the V-22 Osprey take much longer to develop and procure than planned. The F/A-18E/F is a bird in the hand, its supporters say, and its rapid and continued procurement is essential to executing the Navy's current and evolving military strategy.

Program Management and Technical Risks

The F/A-18E/F program is viewed by its proponents as a logical and successive upgrade of the C/D version that does not involve any major technical risks. They point out that the E/F modifications to the airframe and weapon systems are the culmination of studies that began in 1987 with the proposed Hornet 2000 design, which was later modified and refined to more modest proportions. Its critics note, on the other hand, that the program involved the design and fabrication of new wing and tail structures, lengthened fuselage, installation of a new engine with redesigned air inlets, and incorporation of more advanced avionics and cockpit features. The Defense Science Board concluded in February 1993, however, that the F/A-18E/F program involved fewer technical risks than the Air Force's F-22 stealth fighter program.

Now produced by Boeing (since its acquisition of McDonnell Douglas in 1997), the F/A-18E/F has found strong support in the Congress, despite sporadic criticism by advocates of other aircraft or those concerned about the cost and performance of the F/A-18E/F. For example, in a letter to Defense Secretary Cohen on November 23, 1998, Sen. Russell Feingold voiced concern "about the performance of the Super Hornet in maneuvering dogfights" and asked Secretary Cohen to suspend release of

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[21] "Pentagon Response to Cunningham's Comments," *Inside the Navy*, May 27, 1991: 8-9

[22] Lt. John R. Wood, " F-14D Reliability Confounds Critics," *U.S. Naval Institute Proceedings*, Feb. 1993: 83-84.

FY1999 procurement funds pending an investigation by DOD's Inspector General and correction of all maneuvering deficiencies identified in recent operational testing. Navy operational testers concluded that the aircraft's "positive attributes ... outweighed the negative impacts for all critical issues," and in early December 1998 the Navy awarded Boeing a contract to start production of the 30 planes funded in FY1999. In December 2003 the Navy awarded Boeing a $8.6 billion multiyear procurement contract to build 210 Super Hornets between 2005 and 2009. Two aspects of this contract appear noteworthy. The current multiyear procurement contract (for up to 222 Super Hornets by 2004) is for a production rate of 48 aircraft per year, with the flexibility of adding or subtracting up to six aircraft annually without affecting the contract's terms. The new multiyear procurement contract specifies a production rate of only 42 aircraft per year, and allows the Navy to increase orders by six aircraft annually. The annual order can not be reduced without incurring additional costs. Also, the lower annual production rate could hinder attempts to reduce the Super Hornet's per-unit cost.[23]

Congressional Action

Congress has provided some $28 billion for F/A-18E/F and EA-18G funding from FY1992-FY2004. The administration's **FY2005** budget requested $3,406.5 million in F/A-18 procurement funds and $134 million in F/A-18 RDT&E. Of the procurement funding request, $412.5 million was for modifications to aircraft, and $42 million was requested specifically for modifications to the E/F in FY2005.

The Bush Administration's **FY2004** defense budget requested $3.2 billion in overall F/A-18E/F funding, including $3.0 billion to procure 42 aircraft and to fund advance procurement (current year), and $179 million in research and development funds. The Navy's research and development budget submission also included a request of $256.7 million for "EW Development," and $204 million of these funds are to support the development of the EA-18G.

In their report (S.Rept. 108-46, S. 1050) Senate authorizers matched the Administration's request for F/A-18E/F procurement and R&D funding and EW development. Senate authorizers also recommend the Navy enter into a second consecutive multiyear procurement for the F/A-18E/F (Sec. 212) and encouraged the Navy to synchronize this procurement with the aircraft's engine multi year procurement "at the earliest opportunity. (p.73) In their report (H.Rept. 108-106, H.R. 1588) House authorizers added $25 million to the Administration's request for F/A-18E/F procurement funding, and matched all R&D funding requests. The House also separated EA-18G R&D funding from the EW Development program element, and created a new program element (0604271N), providing increased congressional oversight of the program.

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[23] For more information, see Bloomberg News, "Navy Awards Boeing $9.6 Billion in Contracts," *Los Angeles Times,* Dec., 30, 2003. Robert Wall, "Navy Commitment," *Aviation Week & Space Technology,* Jan. 5, 2004. "Navy Awards Boeing $9.6 Billion in Super Hornet and EA-18G Contracts," Press Release, The Boeing Company, St. Louis, Dec. 29, 2003.

Authorization conferees (H.R. 1588, H.Rept. 108-354) matched the Administration's request for procurement funding ($2.9 billion for 42 aircraft, and $84.7 million in advance procurement), and RDT&E funding. Conferees rejected the House proposal to create a new EA-18G program element. Conferees adopted the House provision (sec. 121) authorizing the Navy to enter into a F/A-18E, F/A-19F, EA-18G multi-year procurement for up to 234 aircraft.

House appropriators (H.R. 2658, H.Rept. 108-187), Senate appropriators (S. 1382, S.Rept. 108-87) and conferees (H.R. 2658, H.Rept. 108-283) matched all requests for F/A-18E/F and EA-18G funding.

The Bush Administration's amended **FY2003** defense budget, submitted February 4, 2002, included a request for $3.1 billion in procurement funds to build 44 Super Hornets, and $107 million to support F/A-18E/F RDT&E. In their report (H.Rept. 107-436, H.R. 4546), House authorizers matched the Navy's $3.07 billion request for multi-year procurement (MYP) and $86.2 million in advanced procurement, current year (AP CY) funds. The Senate, however, expressed concern over the Navy's procurement request. Writing that "...the committee believes that greater efficiency can be maintained if the Navy were to continue buying F/A-18E/F aircraft at level rates until the Navy's inventory requirements are met "(S.Rept. 107-151, S. 2514, p.68), Senate authorizers increased the Navy's MYP request by $240 million to buy four additional aircraft (48 total). Senate authorizers also matched the Super Hornet AP CY request. Authorization conferees (H.Rept. 107-772, H.R. 4546) followed the Senate and increased the MYP request by $240 million to buy four additional aircraft. Conferees also cut $15 million from the procurement request due to cost growth, and matched the $86.2 million AP CY request.

House appropriators (H.Rept. 107-532, H.R. 5010) supported the purchase of 44 aircraft in FY03. They cut, however, the MYP request by $15 million due to cost growth in support equipment. Appropriators also added $4 million for the Super Hornet's ALQ-214 radar countermeasures system, and $14 million for the acquisition of additional reconnaissance and targeting pods. Like Senate authorizers, Senate appropriators (S.Rept. 107-213, H.R. 5010) increased the Navy's MYP request by $240 million for four additional aircraft. They also cut the MYP request by $21 equipment (ancillary equipment), $15 million (excessive growth in training equipment), $54.9 million (termination of the Shared Reconnaissance Pod), and $13.2 million (excessive growth in production engineering)

Appropriations conferees (H.Rept. 107-732, H.R. 5010) in essence split the difference between the House and Senate by increasing the MYP request by $120 million for two additional aircraft. Conferees also added $2.4 million to support the Shared Airborne Reconnaissance Pod program. They cut $7.5 million from the ALQ-214 program, $21 million due to ancillary equipment, and $13.2 million due to excessive growth in production engineering. Conferees matched the Navy's request for AP CY.

In July 2001, the Bush Administration submitted its amended budget request for **FY2002**, including a total of $3.4 billion for the Super Hornet. $3.1 billion was requested to build 48 aircraft, $88.9 million for advanced procurement (current year), and $253 million for RDT&E. Congressional authorizors supported the Navy's

procurement request. Authorization conferees (S.Rept. 107-333, S. 1438) provided an additional $13 million to accelerate the purchase of defensive countermeasures. Congressional appropriators supported the request to build 48 aircraft in FY2002, but at a slightly reduced funding level. Citing excessive growth in ancillary support equipment, appropriations conferees (H.Rept. 107-350, H.R. 3338) cut the request by $30 million. Appropriations conferees increased the F/A-18E/F RDT&E request by $6 million to accelerate work on SHARP targeting pods.

The Administration's **FY2001** defense budget, submitted on February 7, 2000, requested $3,080.6 million for procurement of 42 F/A-18E/Fs (and initial spares) — $3,061.4 million in Navy procurement ($2,818.5 for FY2001 and $101.1 in current year advanced procurement) and $19.2 million in Navy R&D funding. The Senate Armed Services Committee, in their report (S.Rept. 106-292, S. 2549), and House Appropriations Committee in their report (H.Rept. 106-644, H.R. 4576 recommended funding the Administration's request. The House Armed Services Committee recommended in its report (H.Rept. 106-616, H.R. 4205, the largest reduction in the F/A-18 E/F program, a reduction of $205.8 million to purchase three fewer aircraft than requested. The Senate Appropriations Committee in its report (S.Rept. 106-298, S. 2593, supported the 42 aircraft purchase, but at funding a level $42.6 million less than requested. The Appropriations Conference Report (H.R. 4567) adopted the Senate position, reducing $13 million from the Administration's request to accommodate "Production Engineering Support Cost Growth," and $29.6 million for "Premature IDECM RFCM Production Quantities." Authorization Conferees (H.R. 4205) also reduced the Administration's request by $13 million "due to production engineering support cost growth." (p. 581)

For **FY2000**, the F/A-18E/F program was funded as requested: $2,996.8 million in Navy procurement funds ($2,854.2 million) and R&D funds ($142.6 million) for a 36-plane buy. The Navy also requested congressional approval to begin a 5-year, 222-aircraft multiyear procurement contract that would cost some $15.2 billion, which was projected to be 7.4% less than annual procurements of these planes in FY2000-FY2004 would cost. Congressional approval of multiyear procurement was provided in FY2000 authorizations and appropriations bills.

The House version of the FY2000 defense authorizations bill (H.R. 1401), passed on June 10, 1999, contained a provision (Section 121) limiting the Navy's authority to enter into a multiyear contract until the Secretary of Defense certifies that the results of the aircraft's operational test and evaluation meet key performance parameters and requirements and that the multiyear contract cost is at least 7.4% less than the cost of annual contracts. Similar language was contained in Section 125 of the Senate version of the FY2000 authorizations bill (S. 1059), passed on May 27, 1999, when such language in a modified amendment by Senator Russell Feingold was passed by voice vote. A cost-cap amendment proposed by Senator Feingold, which limited the production cost of airframes, engines, and contractor-furnished equipment to the figures stated by the Navy and Boeing as the amount needed in FY2000-FY2004 for such production, was rejected by a vote of 87 to 11. In floor debate Senator Feingold criticized the cost-effectiveness and performance of the new E/F version compared to the older C/D version and opposed starting multiyear procurement of the F/A-18E/F in 2000. (*Congressional Record*, May 27, 1999, S6180-S6190.) House and Senate conferees agreed on August 5, 1999, in H.Rept.

106-301 to fund the F/A-18E/F as requested, with Section 121 setting the conditions for multiyear procurement as noted above. The defense authorizations conference report (H.Rept. 106-301) was passed by the House on September 15 and by the Senate on September 22, 1999.

The Senate version of the FY2000 defense appropriations bill (S. 1122), passed on June 8, 1999, provided $10 million less than the amount requested in procurement funds for the F/A-18E/F but included an additional $14 million in advance procurement funds, buying 48 aircraft in FY2001 instead of the 42 projected. The House version (H.R. 2561), passed on July 22, 1999, funded the program as requested but would not permit multiyear procurements of any new weapon systems, such as the F/A-18E/F. House and Senate conferees agreed to fund the program as requested and authorized multiyear procurement of the F/A-18E/F as provided in Sec.8008 of the FY2000 defense appropriations conference report (H.Rept. 106-371), passed by the House on October 13 and by the Senate on October 14, 1999.

The **FY1999** budget requested $3,157.2 million for the F/A-18E/F program: $2,897.2 million for procurement of 30 aircraft and some $260 million in R&D funds. The House version of the FY1999 defense authorizations bill (H.R. 3616, passed on May 21, 1998) authorized funds for procurement of 27 of the 30 aircraft requested. The House National Security Committee cited uncertainties about procurement plans as well as concerns about the plane's wing problem (H.Rept. 105-532: 59-60). On June 24, 1998, the House appropriated $2,912.5 million in procurement and R&D funds for a 27-plane buy in FY1999 (H.R. 4103; H.Rept. 105-591).

The Senate version of the FY1999 defense authorizations bill (S. 2057, passed June 25, 1998; S.Rept. 105-189), authorized $3,133.8 million in procurement and R&D funding for a 30-plane buy. An amendment by Senator Russell Feingold requiring annual reports on the F/A-18E/F program by the General Accounting Office was agreed to without objection on June 24, 1998. On July 30, 1998, the Senate appropriated $3,136.3 million in procurement and R&D funding for 30 F/A-18E/Fs, after Sen. Feingold's amendment to transfer $219.7 million from the program to the Army National Guard operations and maintenance account was defeated 80 to 19. (Congressional Record, July 30, 1998: 9329-9334, 9358.) House and Senate conferees on the FY1999 defense authorizations bill, passed by the House on September 24 and the Senate on October 1, 1998, agreed to authorize procurement of 30 aircraft, and conferees on the FY1999 defense appropriations bill (H.R. 4103, passed by the House on September 28 and by the Senate on September 29, 1998) agreed to provide $3,093.8 million in procurement and R&D funds for a 30-aircraft program — $63.4 million less than the amount requested.

The **FY1998** defense budget requested $2,459.1 million for the F/A-18E/F ($2,191.6 million for procurement of 20 aircraft and some $267.5 million for research-development). On July 11, 1997, the Senate authorized funding as requested for the program in its version of the FY1998 defense authorizations bill (S. 936). The House version (H.R. 1119, passed June 25, 1997) authorized $1,592.2 million (procurement, $1,438.9 million; R&D, $153.3 million). The House National Security Committee report stated "that until the review of the QDR by the independent National Defense Panel is completed in December 1997 and assessed

by the Congress, the F/A-18E/F program should proceed at a slower pace." (H.Rept. 105-132: 64.) The Defense Department's Quadrennial Defense Review (QDR) recommended reducing procurement of F/A-18E/Fs from the projected 1,000 aircraft to 548, or buying up to 785 aircraft if the Joint Strike Fighter (JSF) program were delayed or deemed too expensive. On July 15, 1997, the Senate appropriated $2,433.1 million (procurement as requested and $241.5 million of the $267.5 million requested in R&D funding) in its version of the FY1998 defense appropriations bill (S. 1005). On July 29, 1997, the House appropriated $2,349.9 million (procurement as requested and $158.3 million of the $267.5 million requested in R&D funding) in its version of the FY1998 defense appropriations bill (H.R. 2266).

The conference report (H.Rept. 105-265) on the FY1998 defense appropriations bill (H.R. 2266/P.L. 105-56), passed by the House and Senate on September 25, 1997, provided $2,436.1 million of the $2,459.1 million requested for the program in FY1998, funding procurement as requested and providing $244.5 million of some $267.5 million requested for R&D). The conference report (H.Rept. 105-340) on the FY1998 defense authorizations bill (H.R. 1119), approved by the House on October 28 and by the Senate on November 6, 1997, authorized funding as requested.

The **FY1997** budget requested $2,515.3 million for the F/A-18E/F program — $2,154.8 million for procurement of an initial buy of 12 aircraft and $360.5 million in R&D funds. The House authorized the requested funding in the FY1997 defense authorizations bill (H.R. 3230, passed May 15, 1996). The House version of the FY1997 defense appropriations bill (H.R. 3610, passed June 13, 1996) funded procurement as requested with somewhat more than was requested in development funds. The Senate authorized funding as requested for the F/A-18E/F program as well as procurement funds for six F/A-18C/Ds that were not in the Administration's budget but were requested by the Navy in hearings. The Senate appropriated funding as requested for the F/A-18E/F program as well as procurement funds for 12 F/A-18C/Ds.

During Senate debate on the FY1997 defense authorization bill (S. 1745, passed July 10, 1996), Senator Feingold proposed an amendment to withhold all procurement funding for the F/A-18E/F pending a cost-benefit analysis comparing the E/F and C/D versions. Citing recent GAO conclusions that the F/A- 18E/F provides only marginal improvements over the C/D version at much higher costs, he argued that these conclusions raised serious questions that should be addressed before releasing FY1997 funds for production of the first 12 F/A-18E/Fs. Senators Warner, Nunn, Bond, and Ashcroft opposed this course, which they argued would only delay production of an aircraft that the Navy needed for its better performance capabilities compared to the current C/D version.

A compromise amendment was agreed to whereby 10% of authorized procurement funding for the program in FY1997 would be withheld until 30 days after receipt of DOD's cost-benefit analysis of the E/F and C/D versions, which would be provided to Congress by March 30, 1997. The analysis would include estimates of production costs for "the total number of aircraft realistically expected to be procured" at annual production rates of 18, 24, and 36 planes, and it would compare the costs and combat effectiveness of the E/F vs. the C/D. (*Congressional Record*, June 28, 1996, S7226-S7230, S7246-S7247, and S7266-S7267.) This

language was included in the conference report (H.Rept. 104-724, Section 219), which the House adopted on August 1, 1996, followed by Senate passage on September 10 and signing into law by the President on September 23, 1996 (P.L. 104-201). Similar language was added to the Senate version of the FY1997 appropriations bill (S. 1894, passed July 18, 1996), when the F/A-18 was debated and language calling for a report on the cost-effectiveness of the E/F vs. the C/D model was included in the conference report on FY1997 appropriations (H.Rept. 104-863: 897). The FY1997 omnibus appropriations bill (H.R. 3610/ P.L. 104-208, September 30, 1996) provided $2,498 million for the F/A-18E/F program as well as funding for procurement of six F/A-18C/Ds. An amendment by Senator Bumpers to procure 6 instead of 12 F/A- 18C/Ds was defeated 56-44 in the Senate. (*Congressional Record*, July 17, 1996, S7989-S7994.)